PATENT & TRADEMARK OFFICE
DEC 04 2003

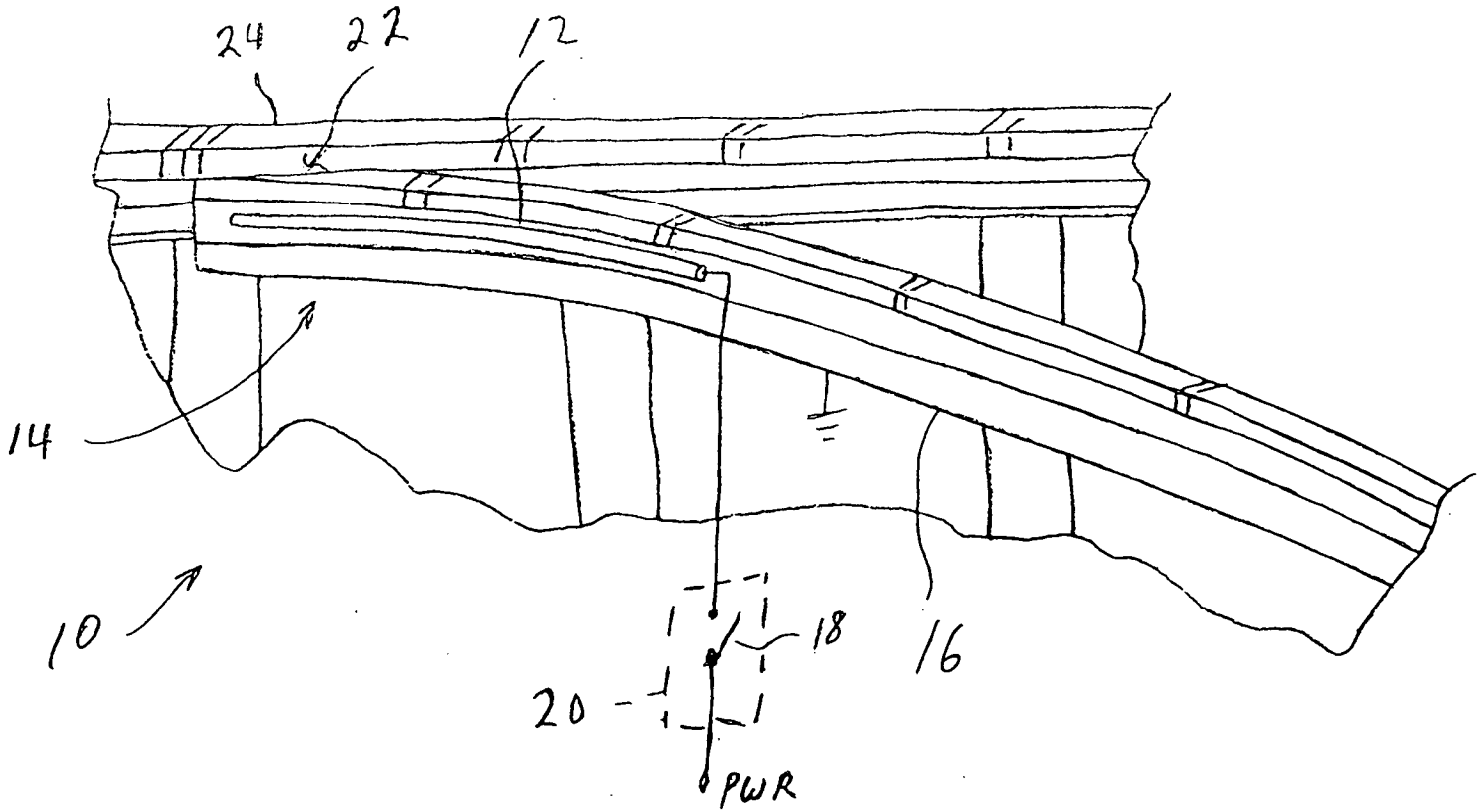


FIG. 1

PRIOR ART

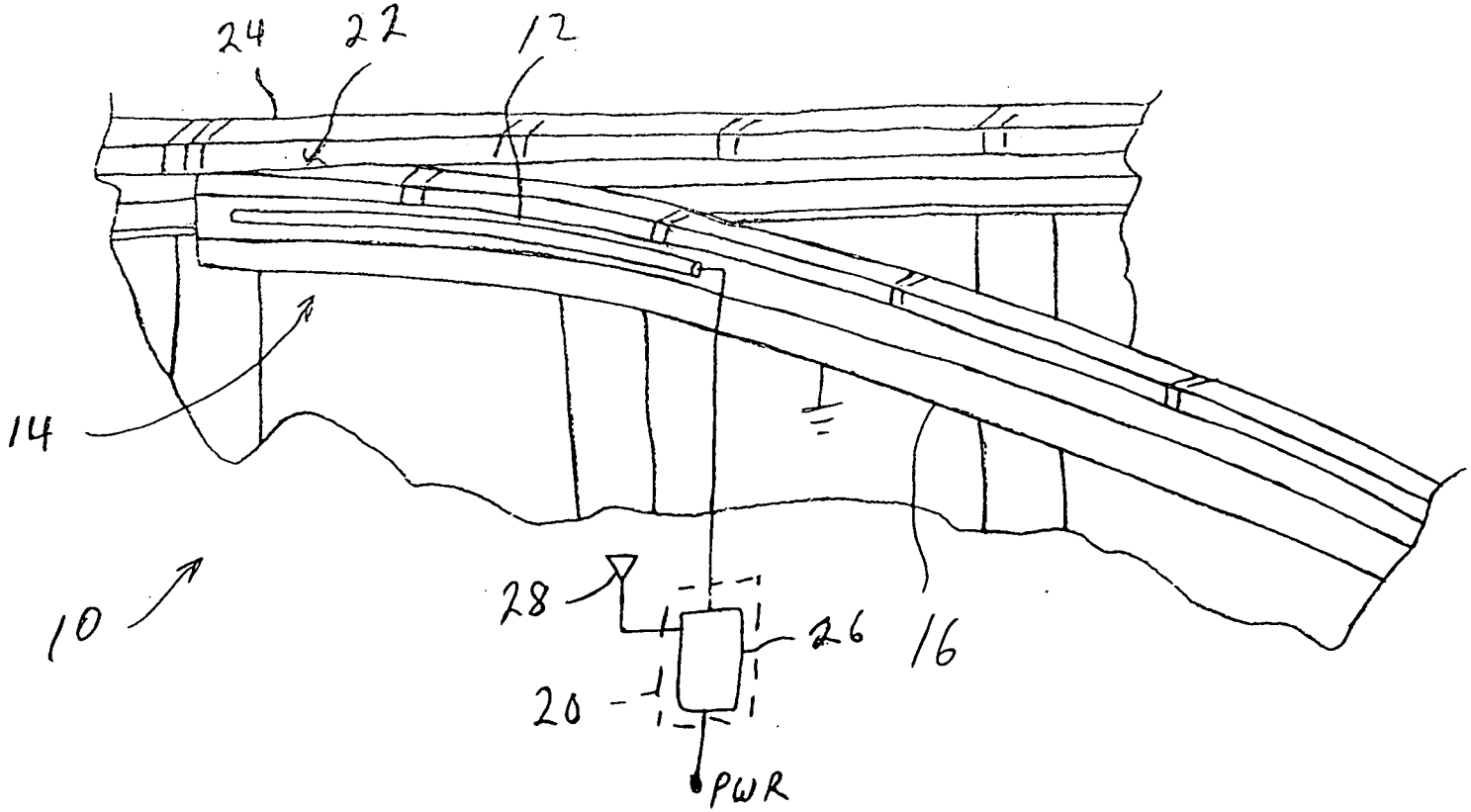


FIG. 2

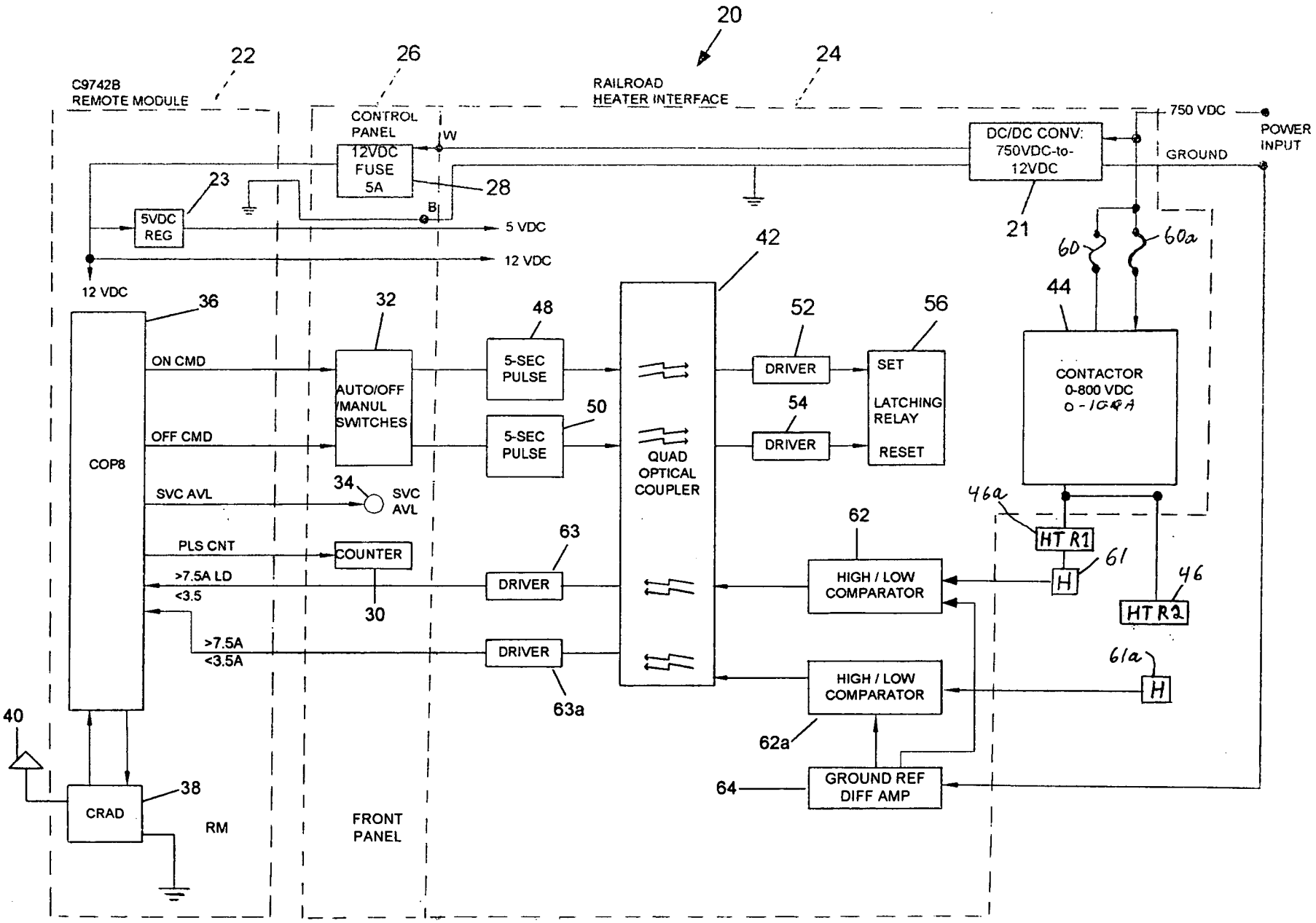

20
22
26
24
C9742B
REMOTE MODULE
CONTROL
PANEL
RAILROAD
HEATER INTERFACE
750 VDC
POWER
INPUT
GROUND
12VDC
FUSE
5A
28
W
B
DC/DC CONV:
750VDC-to-
12VDC
21
23
5VDC
REG
5 VDC
12 VDC
12 VDC
60
60a
42
44
36
32
48
52
56
ON CMD
AUTO/OFF
/MANUL
SWITCHES
5-SEC
PULSE
DRIVER
SET
LATCHING
RELAY
RESET
CONTACTOR
0-800 VDC
0 - 1000A
OFF CMD
5-SEC
PULSE
50
54
DRIVER
COP8
QUAD
OPTICAL
COUPLER
SVC AVL
34
SVC
AVL
46a
HT R1
PLS CNT
COUNTER
63
62
61
H
>7.5A LD
<3.5
DRIVER
HIGH / LOW
COMPARATOR
46
HT R2
30
>7.5A
<3.5A
DRIVER
61a
H
HIGH / LOW
COMPARATOR
40
63a
62a
38
CRAD
RM
FRONT
PANEL
64
GROUND REF
DIFF AMP

FIG. 3

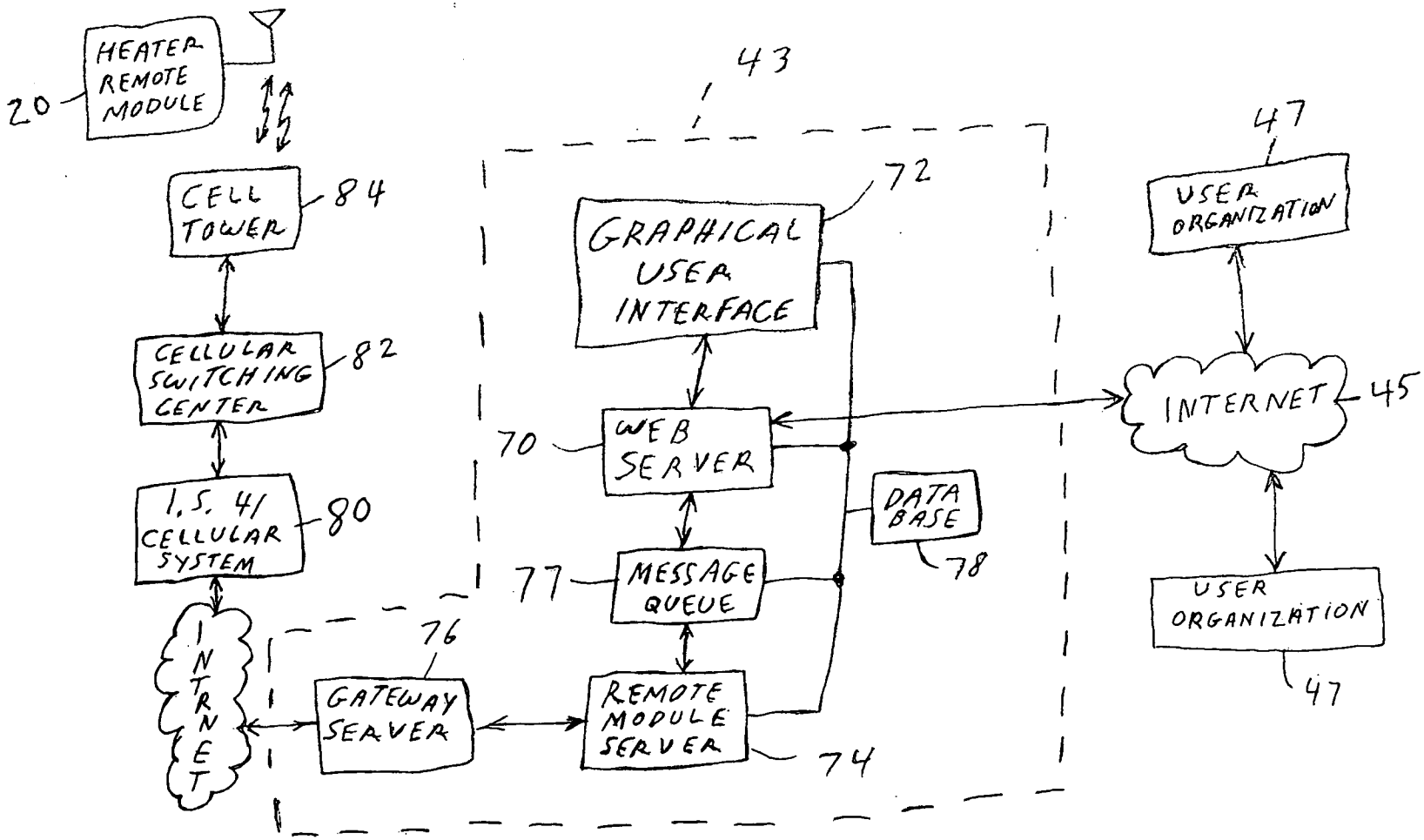

HEATER REMOTE MODULE
20
43
47
CELL TOWER
84
72
USER ORGANIZATION
GRAPHICAL USER INTERFACE
CELLULAR SWITCHING CENTER
82
INTERNET
45
70
WEB SERVER
I.S. 41 CELLULAR SYSTEM
80
DATA BASE
78
77
MESSAGE QUEUE
USER ORGANIZATION
47
INTRNET
76
GATEWAY SEAVER
REMOTE MODULE SERVER
74

FIG. 4

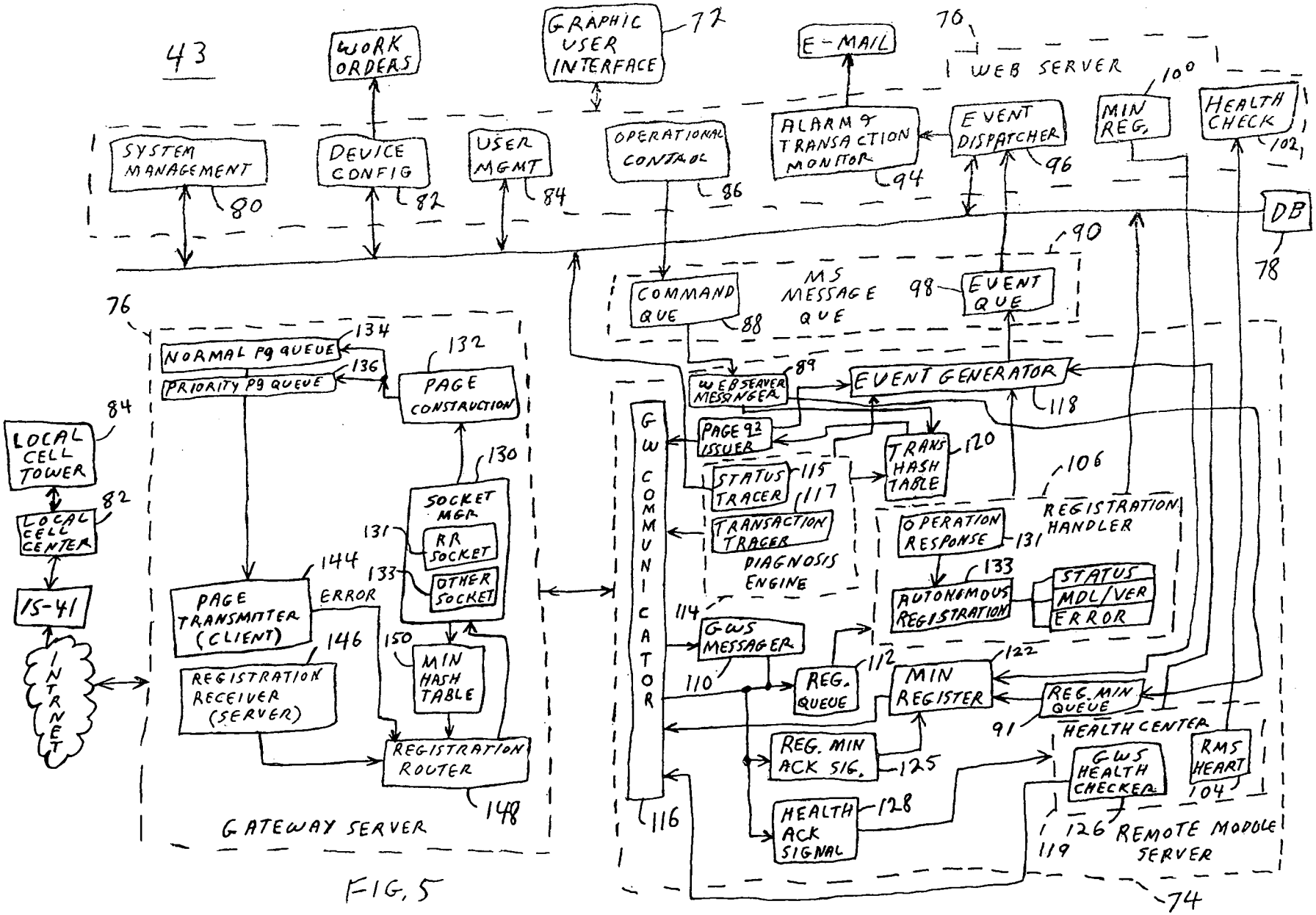

43
WORK ORDERS
GRAPHIC USER INTERFACE
72
E-MAIL
76
WEB SERVER
100
MIN REG.
HEALTH CHECK
102
SYSTEM MANAGEMENT
80
DEVICE CONFIG
82
USER MGMT
84
OPERATIONAL CONTROL
86
ALARM & TRANSACTION MONITOR
94
EVENT DISPATCHER
96
DB
78
90
MS MESSAGE QUE
COMMAND QUE
88
98
EVENT QUE
76
NORMAL PG QUEUE
134
PRIORITY PG QUEUE
136
PAGE CONSTRUCTION
132
WEBSERVER MESSENGER
89
EVENT GENERATOR
118
84
LOCAL CELL TOWER
82
LOCAL CELL CENTER
IS-41
INTERNET
130
SOCKET MGR.
131
RR SOCKET
133
OTHER SOCKET
144
PAGE TRANSMITTER (CLIENT)
ERROR
146
REGISTRATION RECEIVER (SERVER)
150
MIN HASH TABLE
REGISTRATION ROUTER
148
GATEWAY SERVER
GW COMMUNICATOR
116
PAGE REQ ISSUER
STATUS TRACER
115
117
TRANSACTION TRACER
DIAGNOSIS ENGINE
TRANS HASH TABLE
120
106
REGISTRATION HANDLER
OPERATION RESPONSE
131
133
AUTONOMOUS REGISTRATION
STATUS
MDL/VER
ERROR
114
GWS MESSAGER
110
REG. QUEUE
112
MIN REGISTER
122
REG. MIN QUEUE
91
HEALTH CENTER
REG. MIN ACK SIG.
125
GWS HEALTH CHECKER
RMS HEART
104
HEALTH ACK SIGNAL
128
126
119
REMOTE MODULE SERVER
74

FIG. 5

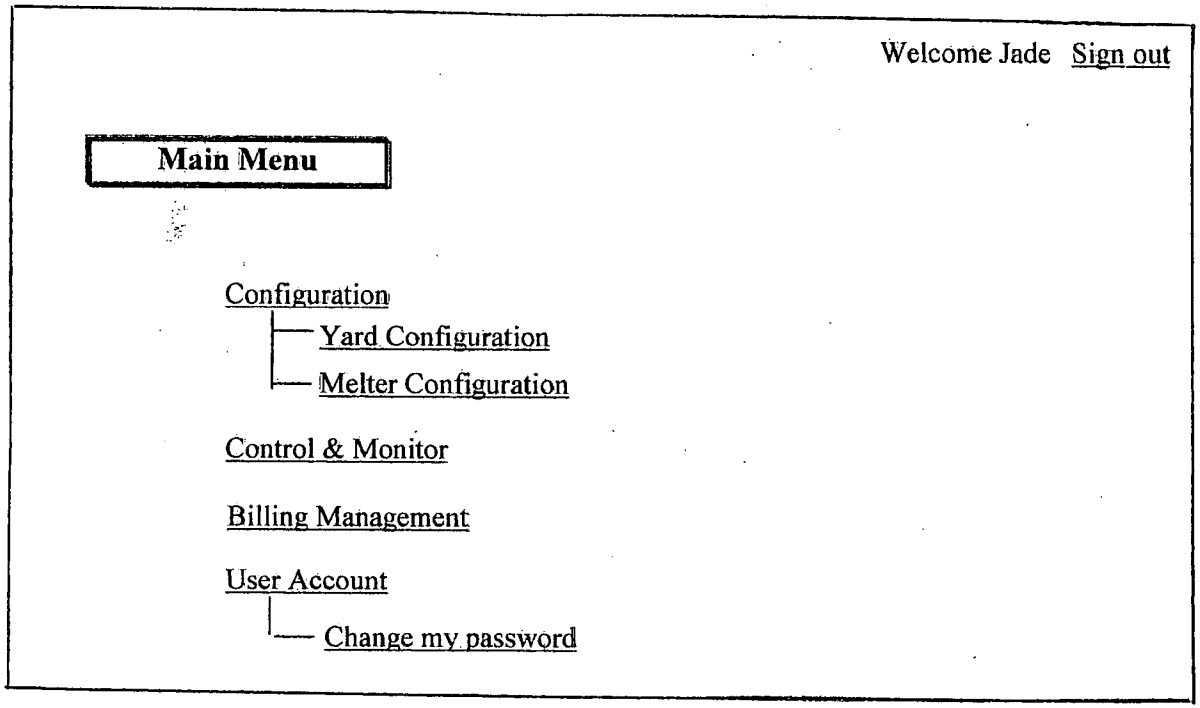

Welcome Jade Sign out
Main Menu
Configuration
Yard Configuration
Melter Configuration
Control & Monitor
Billing Management
User Account
Change my password

FIG. 6

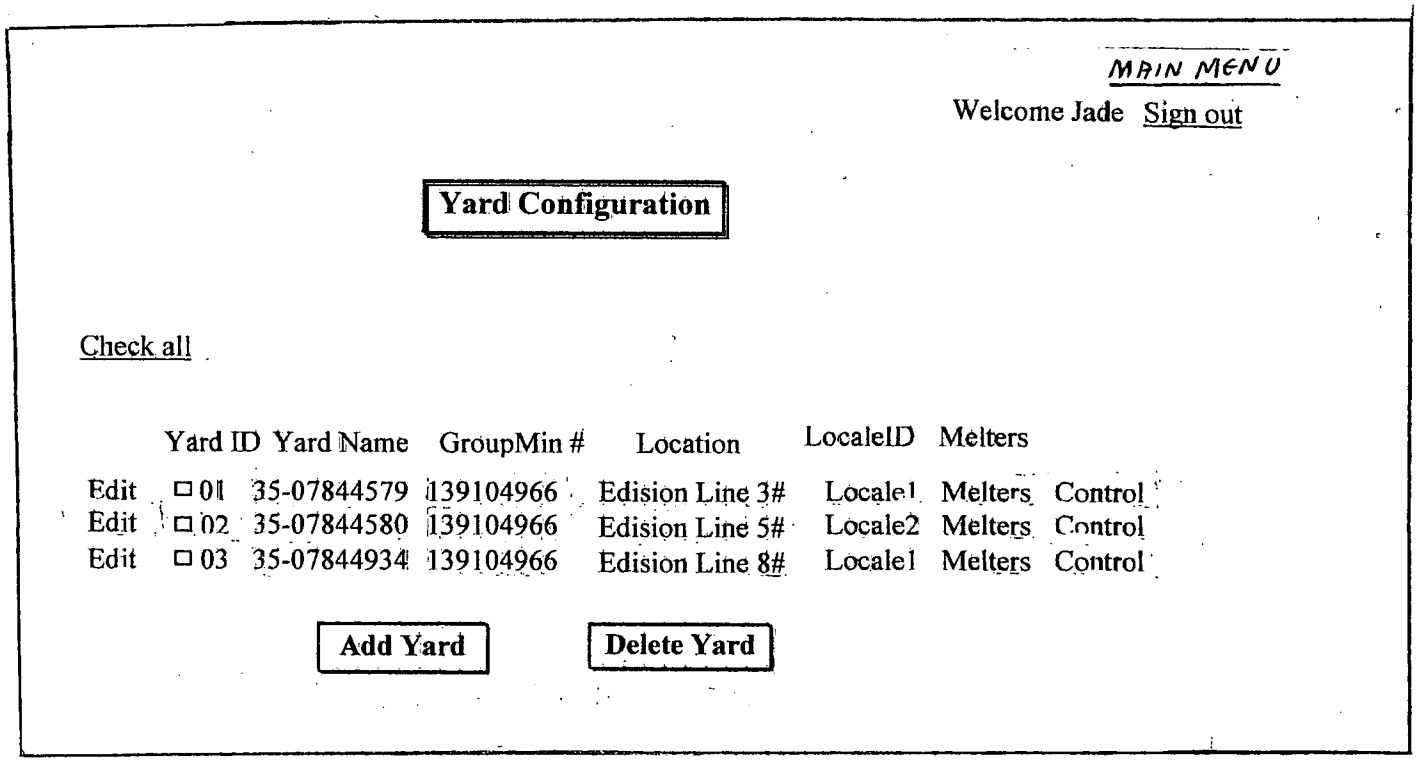

MAIN MENU
Welcome Jade Sign out
Yard Configuration
Check all
Yard ID Yard Name GroupMin # Location LocaleID Melters
Edit 01 35-07844579 139104966 Edision Line 3# Locale1 Melters Control
Edit 02 35-07844580 139104966 Edision Line 5# Locale2 Melters Control
Edit 03 35-07844934 139104966 Edision Line 8# Locale1 Melters Control
Add Yard
Delete Yard

FIG. 6a

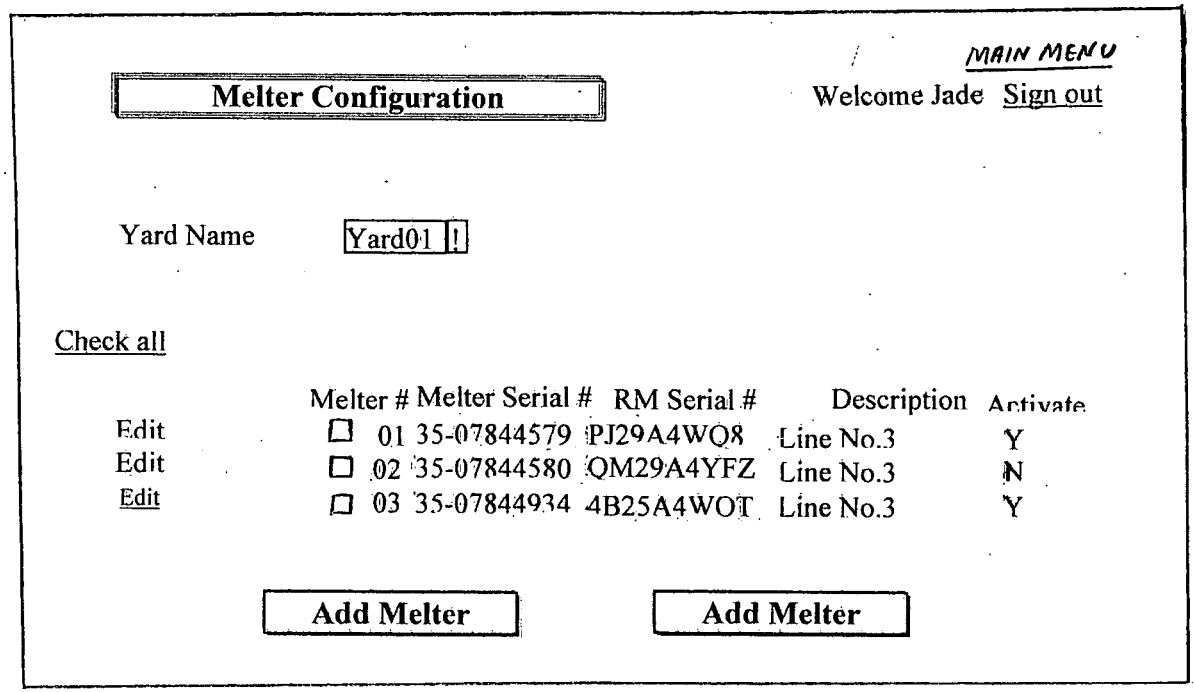

MAIN MENU
Melter Configuration
Welcome Jade Sign out
Yard Name
Yard01
Check all
Melter # Melter Serial # RM Serial # Description Activate
Edit 01 35-07844579 PJ29A4WQ8 Line No.3 Y
Edit 02 35-07844580 QM29A4YFZ Line No.3 N
Edit 03 35-07844934 4B25A4WOT Line No.3 Y
Add Melter
Add Melter

FIG. 6b

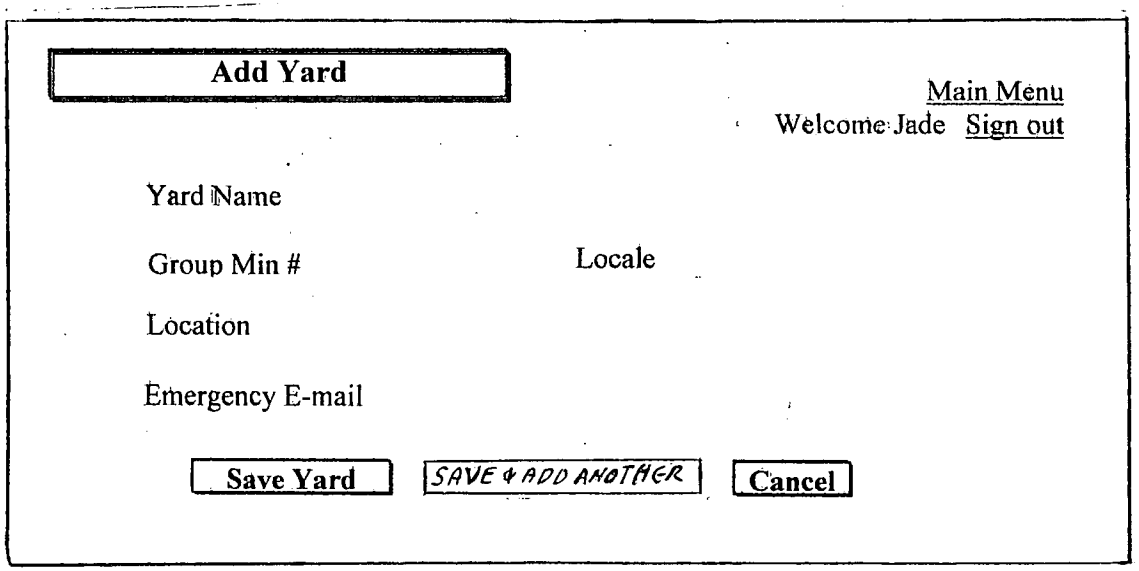

Add Yard
Main Menu
Welcome Jade Sign out
Yard Name
Group Min #
Locale
Location
Emergency E-mail
Save Yard
SAVE & ADD ANOTHER
Cancel

FIG. 6c

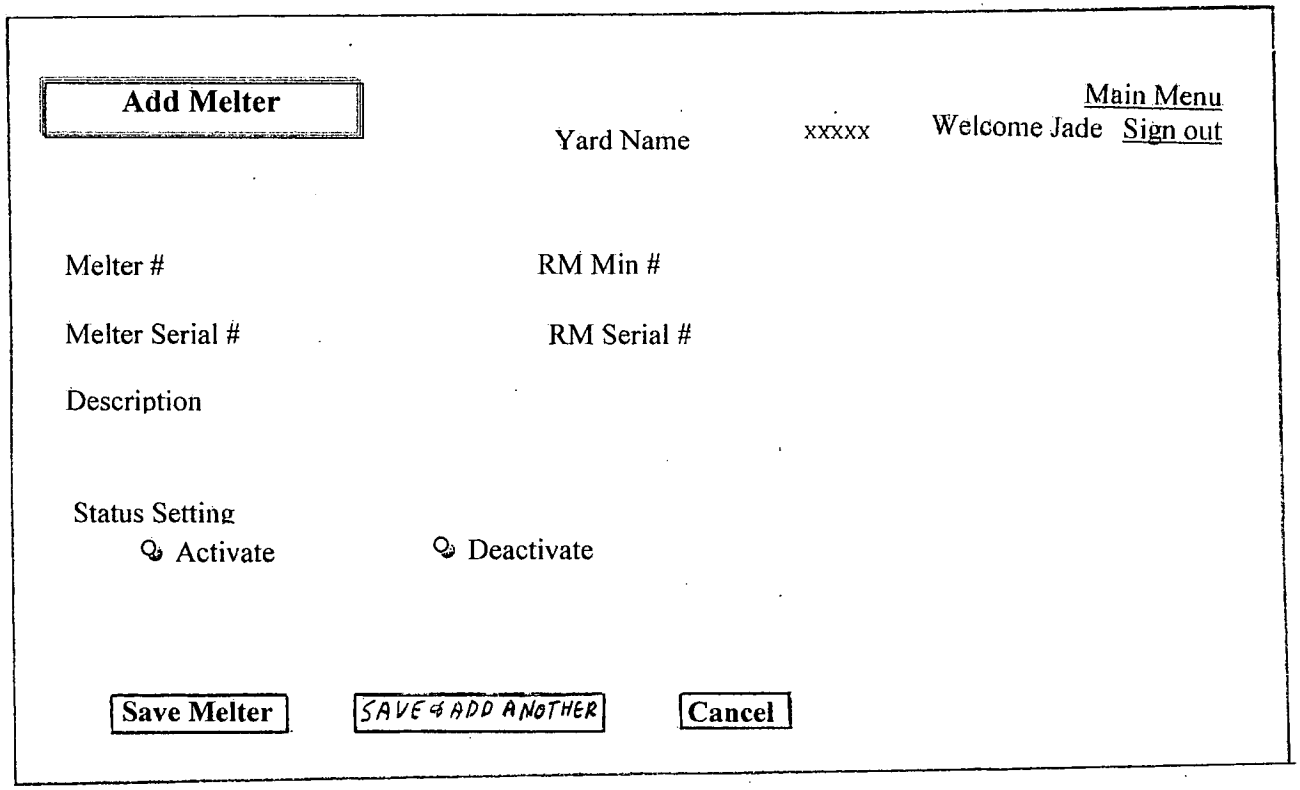

Add Melter
Main Menu
Yard Name
xxxxx
Welcome Jade Sign out
Melter #
RM Min #
Melter Serial #
RM Serial #
Description
Status Setting
Activate
Deactivate
Save Melter
SAVE & ADD ANOTHER
Cancel

FIG. 6d

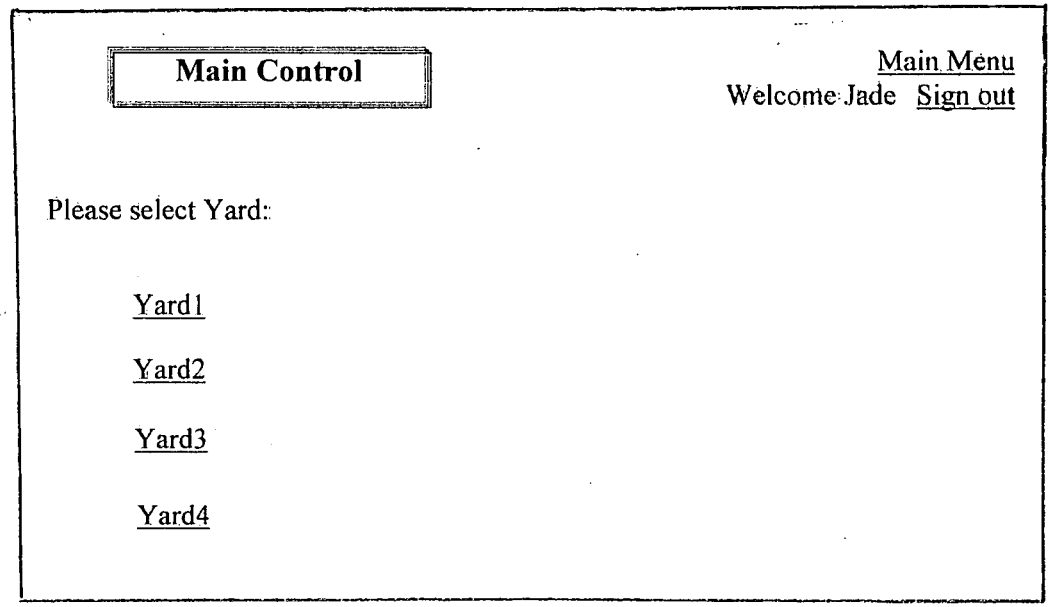

Main Control
Main Menu
Welcome Jade Sign out
Please select Yard:
Yard1
Yard2
Yard3
Yard4

FIG. 6e

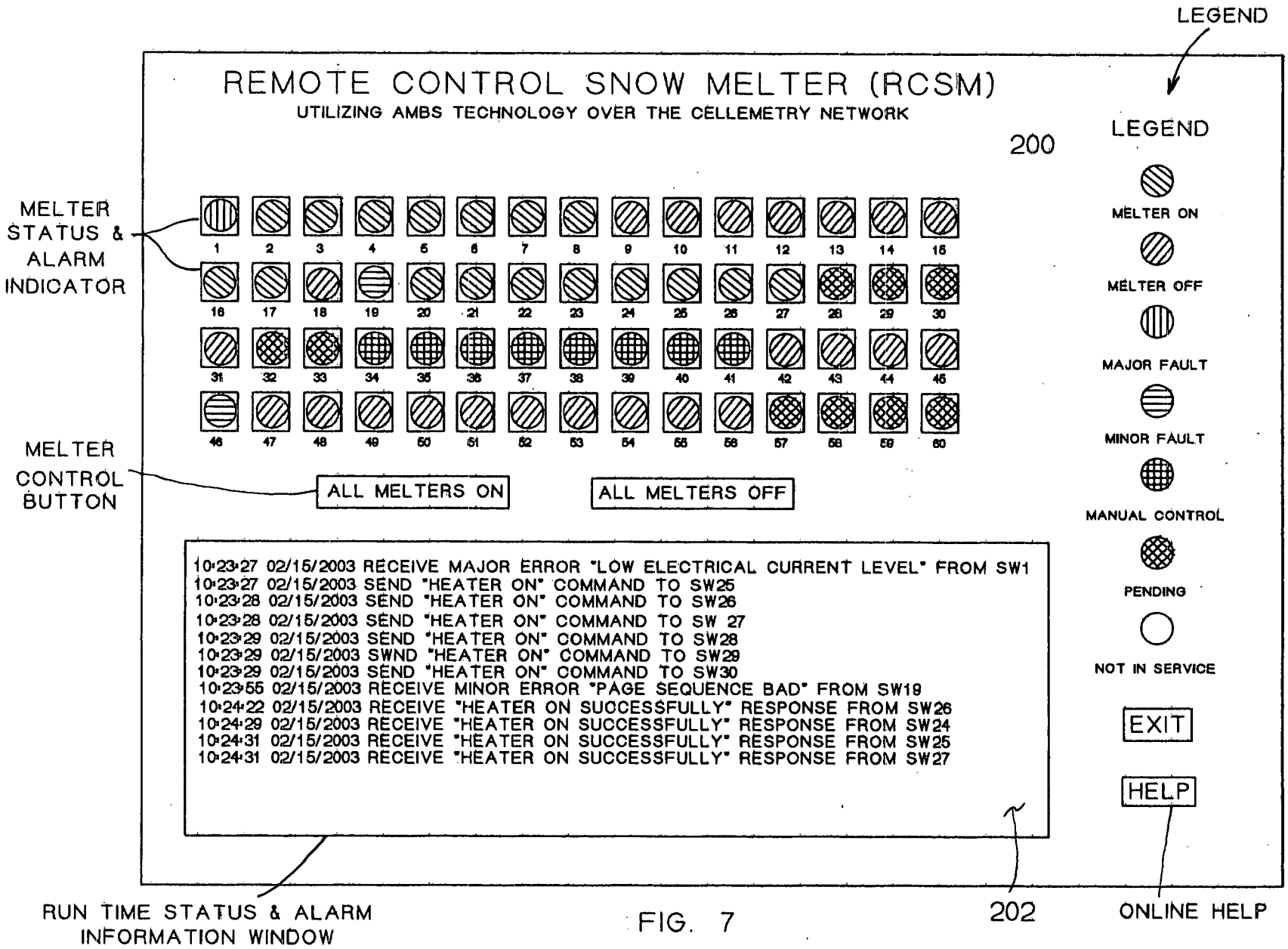

LEGEND
REMOTE CONTROL SNOW MELTER (RCSM)
UTILIZING AMBS TECHNOLOGY OVER THE CELLEMETRY NETWORK
200
LEGEND
MELTER ON
MELTER OFF
MAJOR FAULT
MINOR FAULT
MANUAL CONTROL
PENDING
NOT IN SERVICE
EXIT
HELP
MELTER STATUS & ALARM INDICATOR
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
MELTER CONTROL BUTTON
ALL MELTERS ON
ALL MELTERS OFF
10:23:27 02/15/2003 RECEIVE MAJOR ERROR "LOW ELECTRICAL CURRENT LEVEL" FROM SW1
10:23:27 02/15/2003 SEND "HEATER ON" COMMAND TO SW25
10:23:28 02/15/2003 SEND "HEATER ON" COMMAND TO SW26
10:23:28 02/15/2003 SEND "HEATER ON" COMMAND TO SW 27
10:23:29 02/15/2003 SEND "HEATER ON" COMMAND TO SW28
10:23:29 02/15/2003 SWND "HEATER ON" COMMAND TO SW29
10:23:29 02/15/2003 SEND "HEATER ON" COMMAND TO SW30
10:23:55 02/15/2003 RECEIVE MINOR ERROR "PAGE SEQUENCE BAD" FROM SW19
10:24:22 02/15/2003 RECEIVE "HEATER ON SUCCESSFULLY" RESPONSE FROM SW26
10:24:29 02/15/2003 RECEIVE "HEATER ON SUCCESSFULLY" RESPONSE FROM SW24
10:24:31 02/15/2003 RECEIVE "HEATER ON SUCCESSFULLY" RESPONSE FROM SW25
10:24:31 02/15/2003 RECEIVE "HEATER ON SUCCESSFULLY" RESPONSE FROM SW27
RUN TIME STATUS & ALARM INFORMATION WINDOW
202
ONLINE HELP

FIG. 7

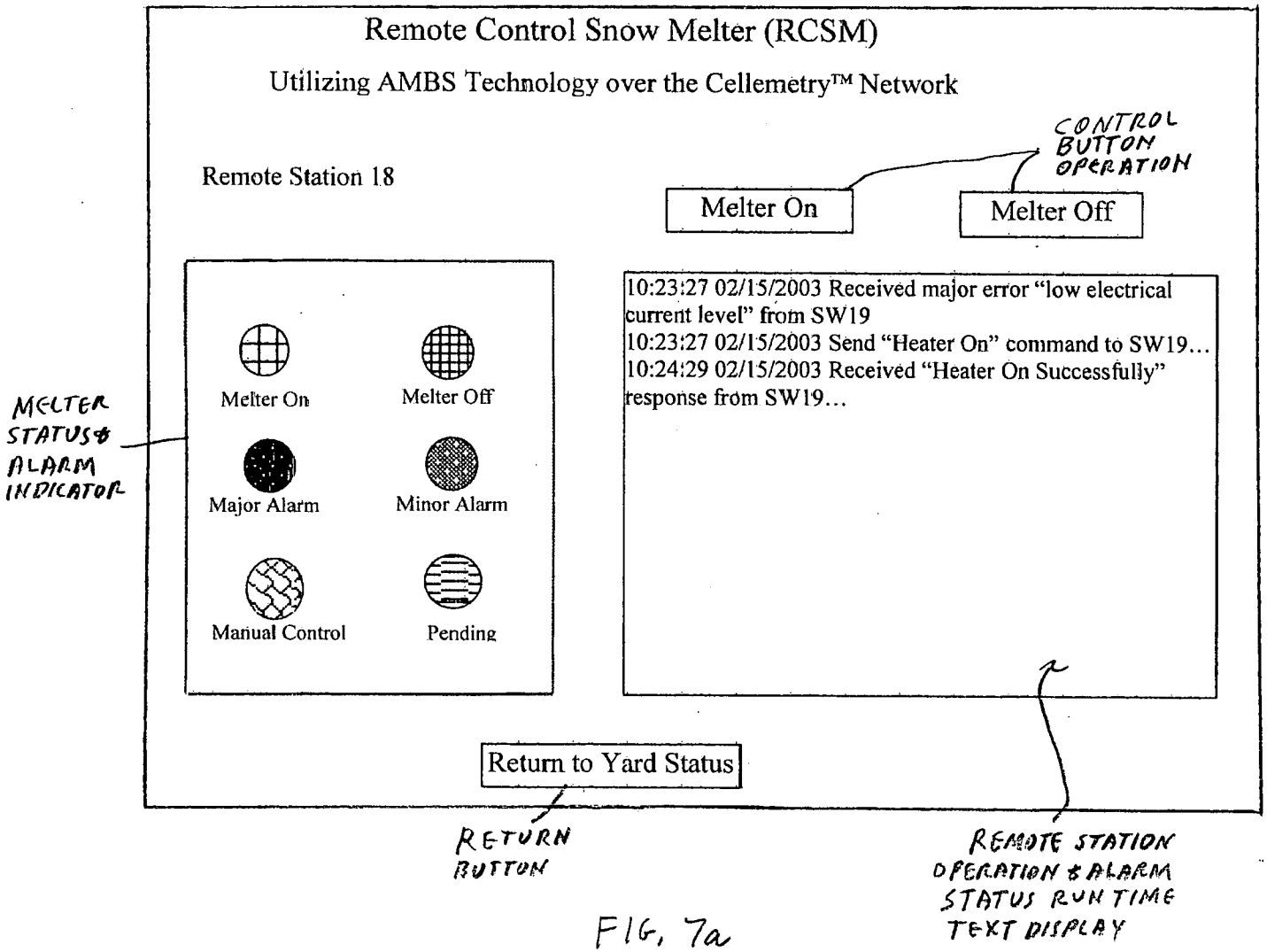
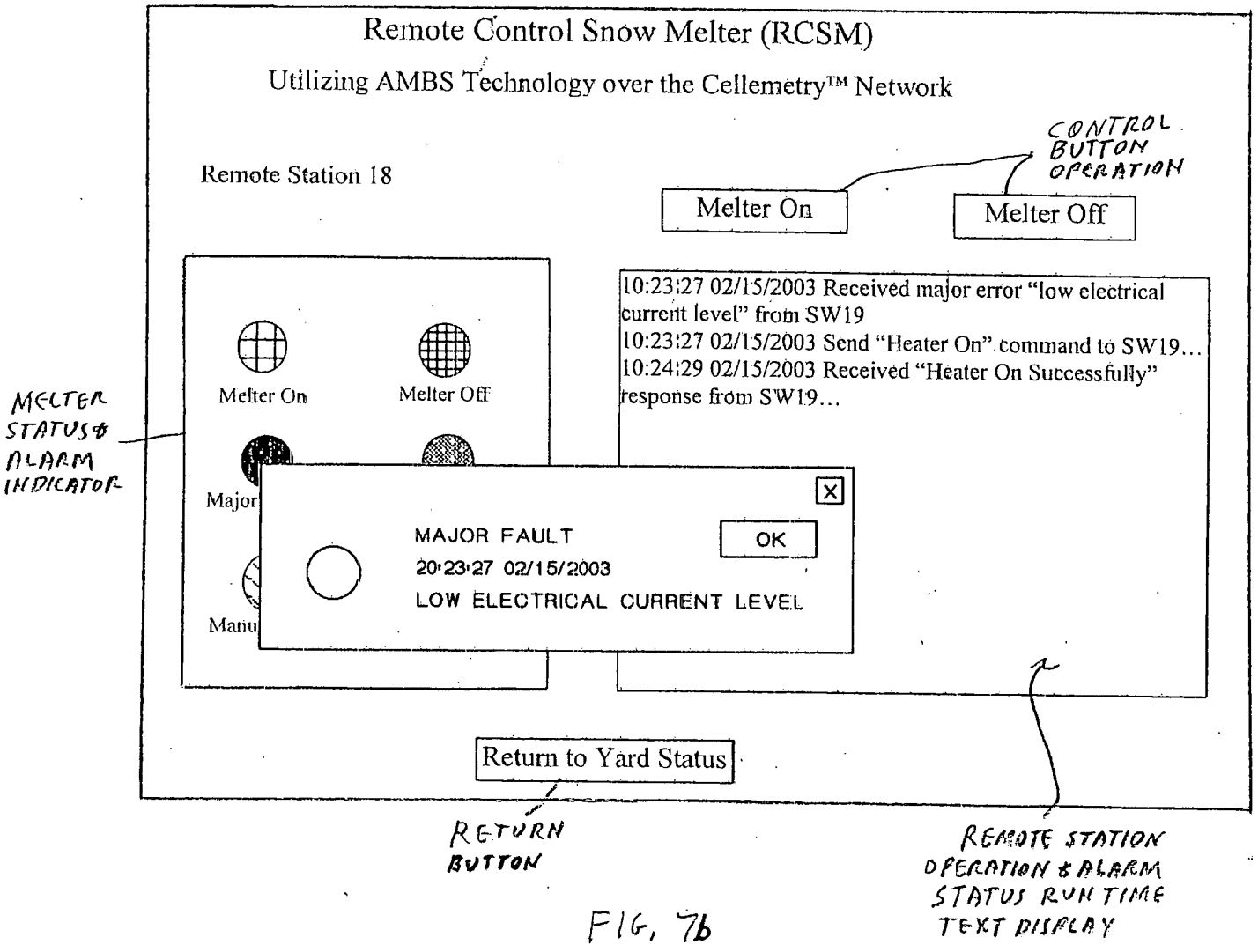
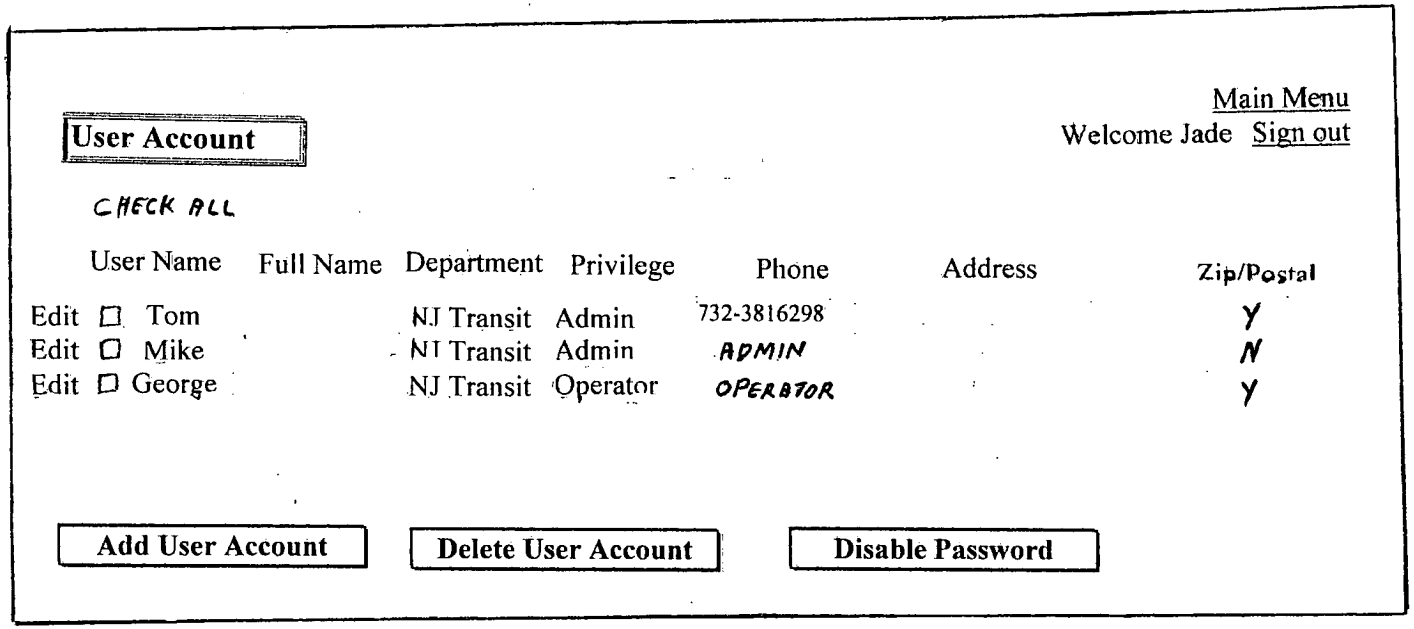

Remote Control Snow Melter (RCSM)
Utilizing AMBS Technology over the Cellemetry™ Network
Remote Station 18
CONTROL BUTTON OPERATION
Melter On
Melter Off
Melter On
Melter Off
Major Alarm
Minor Alarm
Manual Control
Pending
MELTER STATUS & ALARM INDICATOR
10:23:27 02/15/2003 Received major error "low electrical current level" from SW19
10:23:27 02/15/2003 Send "Heater On" command to SW19...
10:24:29 02/15/2003 Received "Heater On Successfully" response from SW19...
Return to Yard Status
RETURN BUTTON
REMOTE STATION OPERATION & ALARM STATUS RUN TIME TEXT DISPLAY

FIG. 7a


Remote Control Snow Melter (RCSM)
Utilizing AMBS Technology over the Cellemetry™ Network
Remote Station 18
CONTROL BUTTON OPERATION
Melter On
Melter Off
Melter On
Melter Off
MELTER STATUS & ALARM INDICATOR
Major
Manu
10:23:27 02/15/2003 Received major error "low electrical current level" from SW19
10:23:27 02/15/2003 Send "Heater On" command to SW19...
10:24:29 02/15/2003 Received "Heater On Successfully" response from SW19...
MAJOR FAULT
OK
20:23:27 02/15/2003
LOW ELECTRICAL CURRENT LEVEL
Return to Yard Status
RETURN BUTTON
REMOTE STATION OPERATION & ALARM STATUS RUN TIME TEXT DISPLAY

FIG, 7b


User Account
Main Menu
Welcome Jade Sign out
CHECK ALL
User Name
Full Name
Department
Privilege
Phone
Address
Zip/Postal
Edit Tom
NJ Transit
Admin
732-3816298
Y
Edit Mike
NJ Transit
Admin
ADMIN
N
Edit George
NJ Transit
Operator
OPERATOR
Y
Add User Account
Delete User Account
Disable Password

FIG, 7c

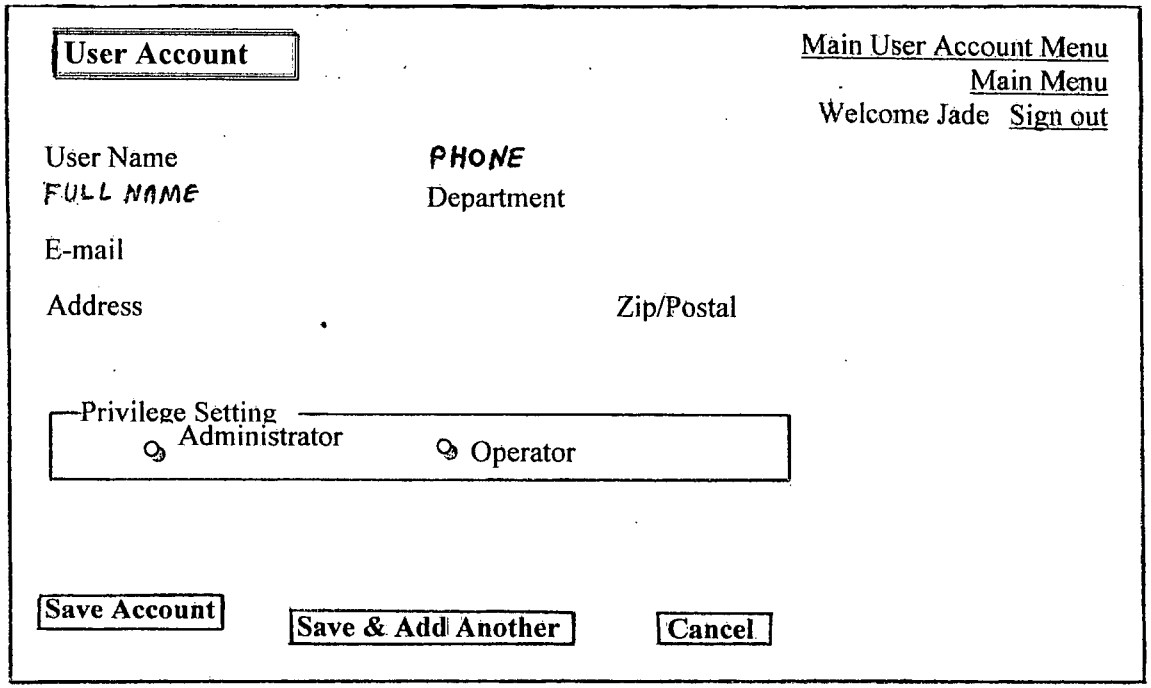

User Account
Main User Account Menu
Main Menu
Welcome Jade Sign out
User Name
PHONE
FULL NAME
Department
E-mail
Address
Zip/Postal
Privilege Setting
Administrator
Operator
Save Account
Save & Add Another
Cancel

FIG. 7d

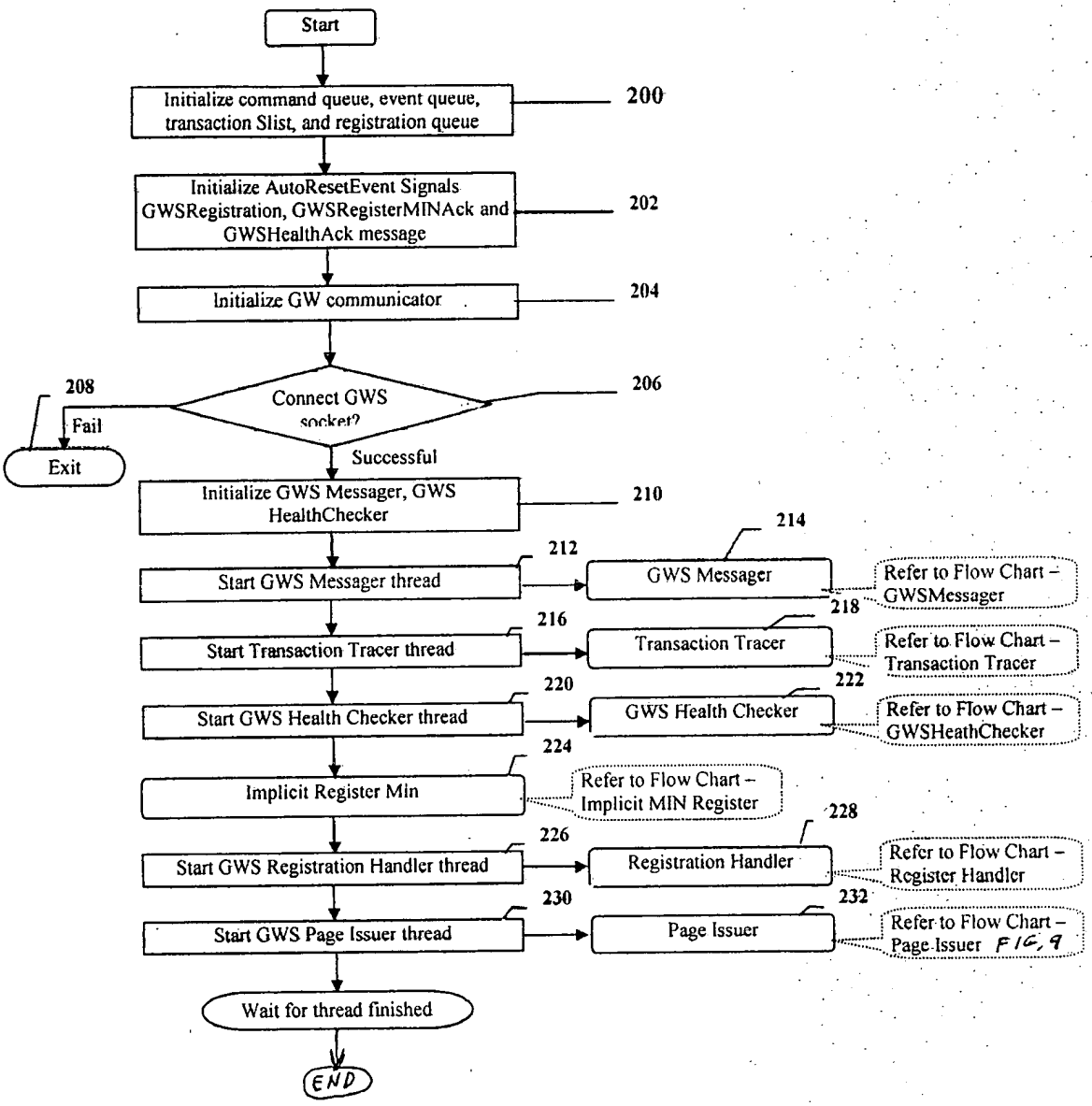

Start
Initialize command queue, event queue, transaction Slist, and registration queue
200
Initialize AutoResetEvent Signals GWSRegistration, GWSRegisterMINAck and GWSHealthAck message
202
Initialize GW communicator
204
Connect GWS socket?
206
208
Fail
Exit
Successful
Initialize GWS Messager, GWS HealthChecker
210
214
212
Start GWS Messager thread
GWS Messager
Refer to Flow Chart – GWSMessager
218
216
Start Transaction Tracer thread
Transaction Tracer
Refer to Flow Chart – Transaction Tracer
222
220
Start GWS Health Checker thread
GWS Health Checker
Refer to Flow Chart – GWSHeathChecker
224
Implicit Register Min
Refer to Flow Chart – Implicit MIN Register
228
226
Start GWS Registration Handler thread
Registration Handler
Refer to Flow Chart – Register Handler
232
230
Start GWS Page Issuer thread
Page Issuer
Refer to Flow Chart – Page Issuer FIG. 9
Wait for thread finished
END

FIG. 8

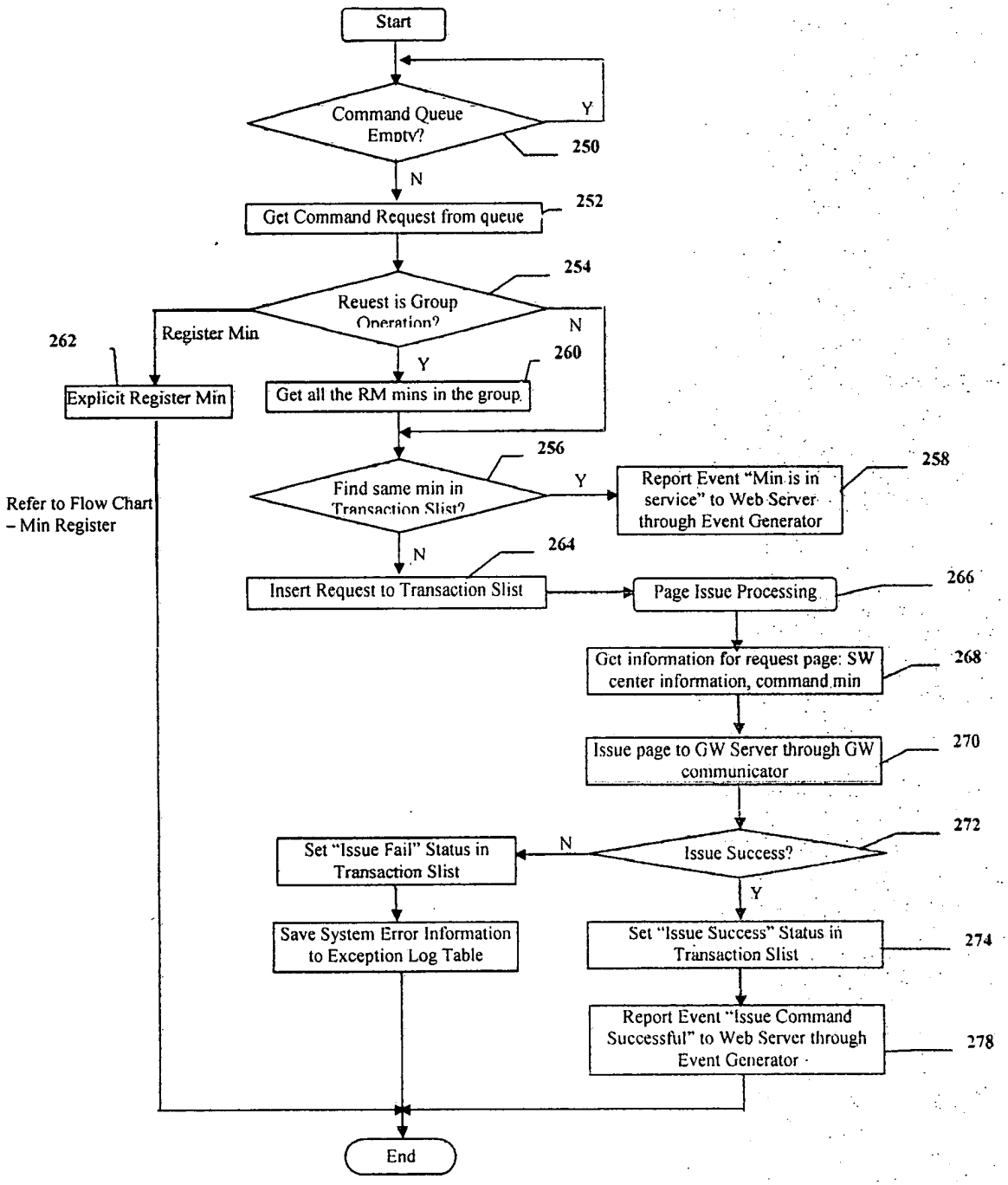

Start
Command Queue Empty?
Y
250
N
Get Command Request from queue
252
254
Reuest is Group Operation?
N
Register Min
262
Y
260
Explicit Register Min
Get all the RM mins in the group
256
Find same min in Transaction Slist?
Y
258
Report Event "Min is in service" to Web Server through Event Generator
Refer to Flow Chart – Min Register
N
264
Insert Request to Transaction Slist
Page Issue Processing
266
Get information for request page: SW center information, command min
268
Issue page to GW Server through GW communicator
270
272
Issue Success?
N
Set "Issue Fail" Status in Transaction Slist
Y
Save System Error Information to Exception Log Table
Set "Issue Success" Status in Transaction Slist
274
Report Event "Issue Command Successful" to Web Server through Event Generator
278
End

FIG. 9

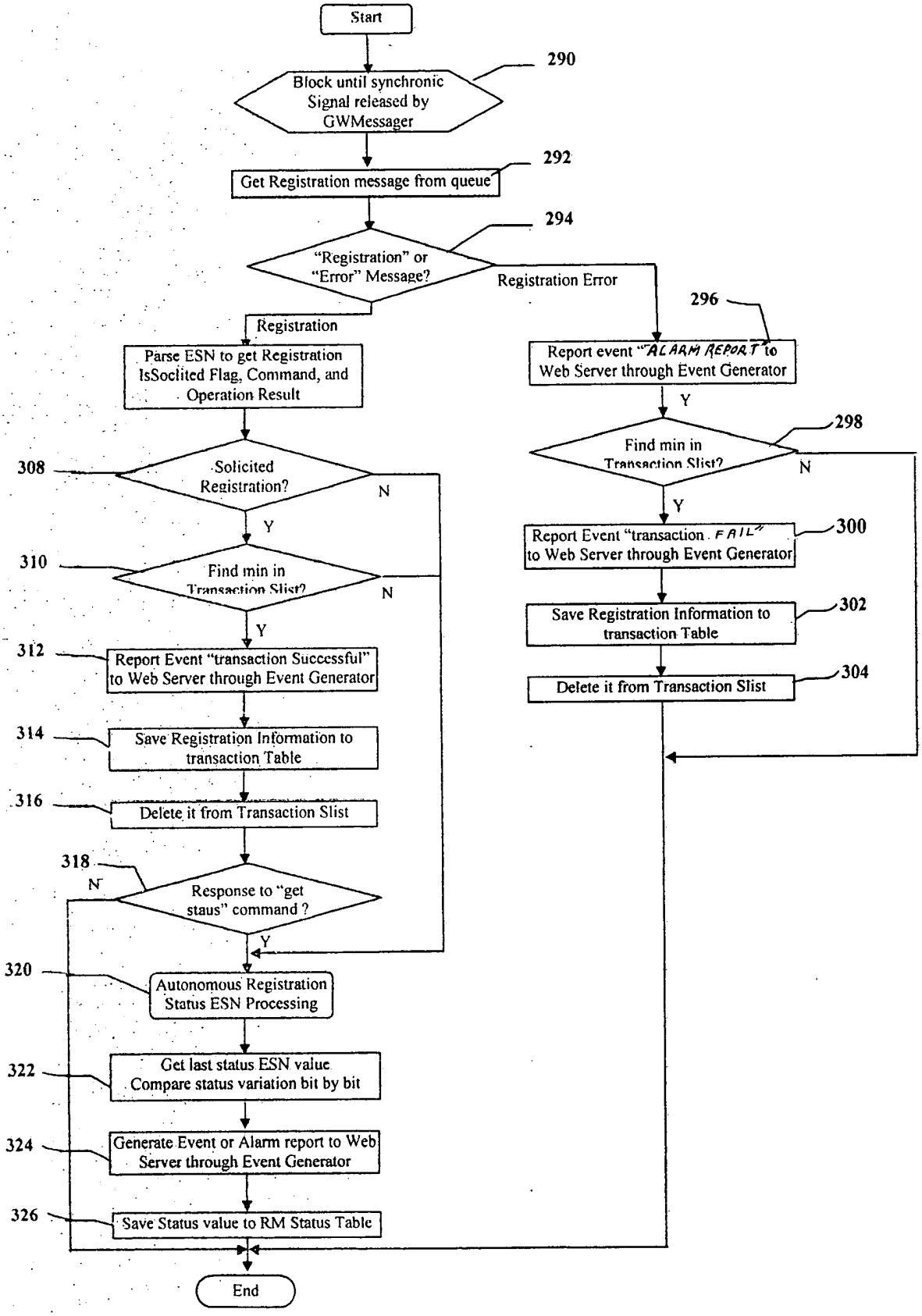

Start
290
Block until synchronic Signal released by GWMessager
292
Get Registration message from queue
294
"Registration" or "Error" Message?
Registration Error
Registration
296
Report event "ALARM REPORT" to Web Server through Event Generator
Y
298
Find min in Transaction Slist?
N
Y
300
Report Event "transaction FAIL" to Web Server through Event Generator
302
Save Registration Information to transaction Table
304
Delete it from Transaction Slist
Parse ESN to get Registration IsSoclited Flag, Command, and Operation Result
308
Solicited Registration?
N
Y
310
Find min in Transaction Slist?
N
Y
312
Report Event "transaction Successful" to Web Server through Event Generator
314
Save Registration Information to transaction Table
316
Delete it from Transaction Slist
318
N
Response to "get staus" command ?
Y
320
Autonomous Registration Status ESN Processing
322
Get last status ESN value Compare status variation bit by bit
324
Generate Event or Alarm report to Web Server through Event Generator
326
Save Status value to RM Status Table
End

FIG. 9a

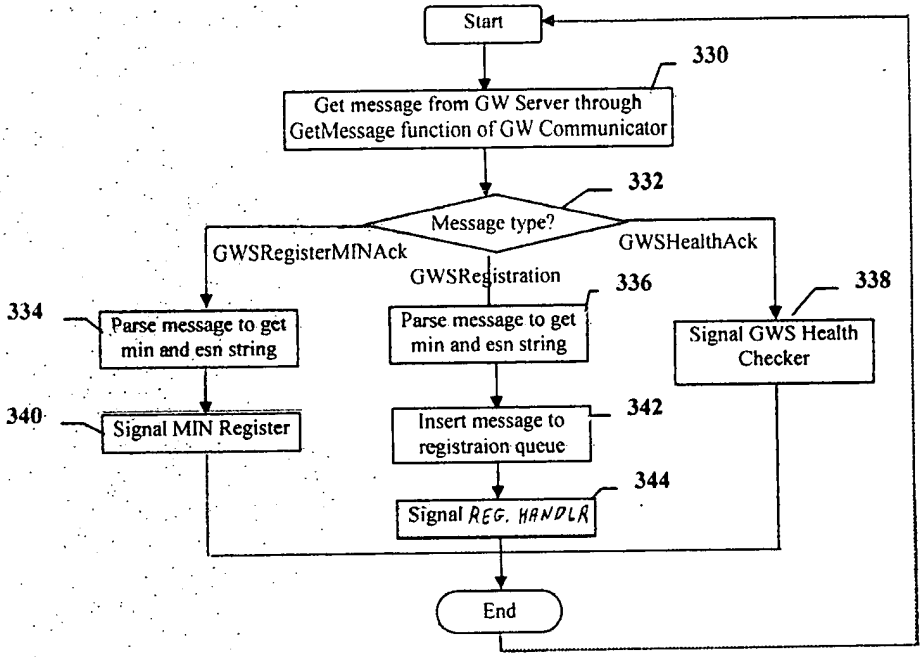

Start
330
Get message from GW Server through GetMessage function of GW Communicator
332
Message type?
GWSRegisterMINAck
GWSRegistration
GWSHealthAck
334
Parse message to get min and esn string
336
Parse message to get min and esn string
338
Signal GWS Health Checker
340
Signal MIN Register
342
Insert message to registraion queue
344
Signal REG. HANDLR
End

FIG. 9b

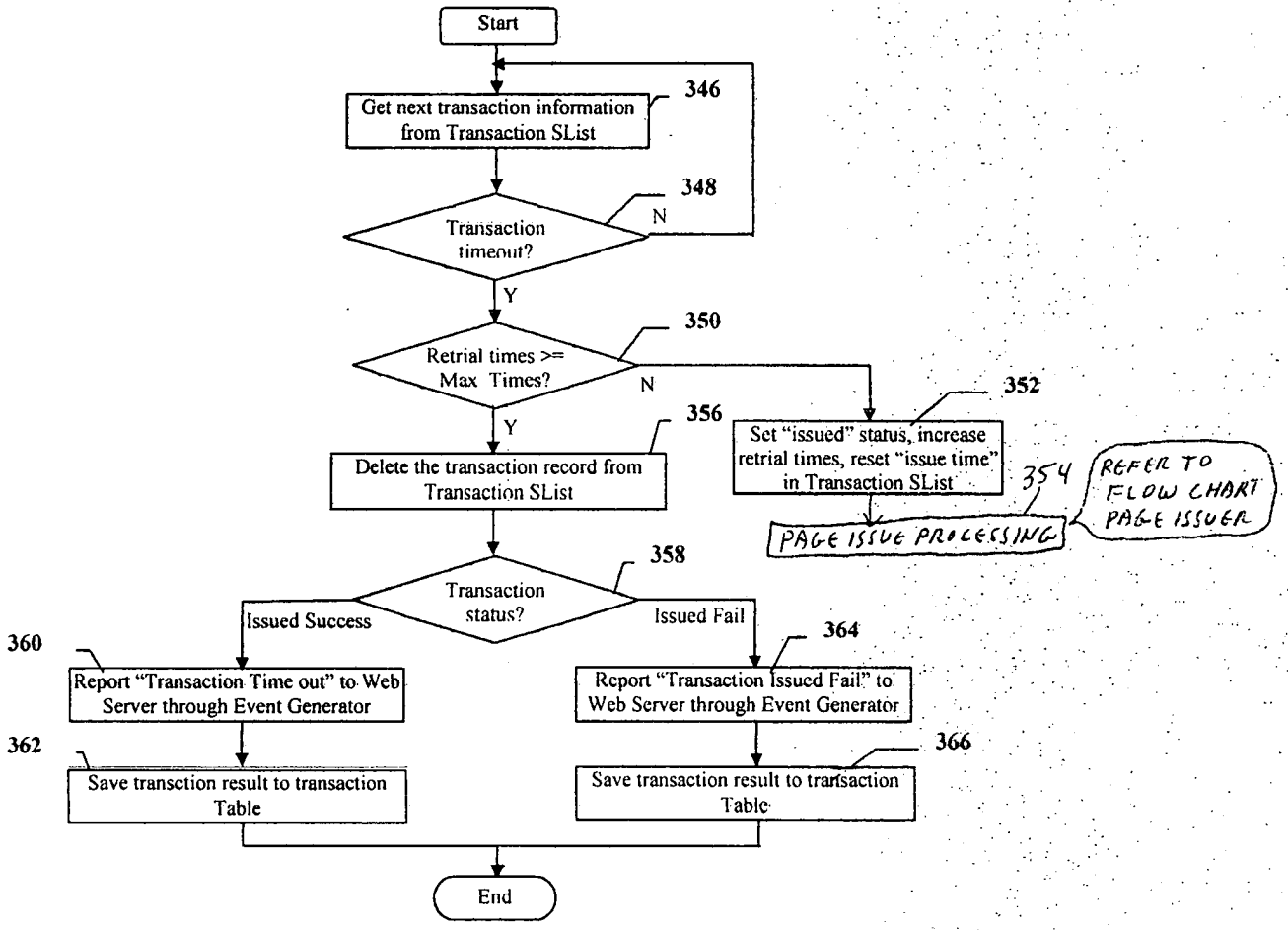

Start
Get next transaction information from Transaction SList
346
Transaction timeout?
348
N
Y
Retrial times >= Max Times?
350
N
Y
Set "issued" status, increase retrial times, reset "issue time" in Transaction SList
352
354
PAGE ISSUE PROCESSING
REFER TO FLOW CHART PAGE ISSUER
Delete the transaction record from Transaction SList
356
Transaction status?
358
Issued Success
Issued Fail
Report "Transaction Time out" to Web Server through Event Generator
360
Report "Transaction Issued Fail" to Web Server through Event Generator
364
Save transction result to transaction Table
362
Save transaction result to transaction Table
366
End

FIG. 9c

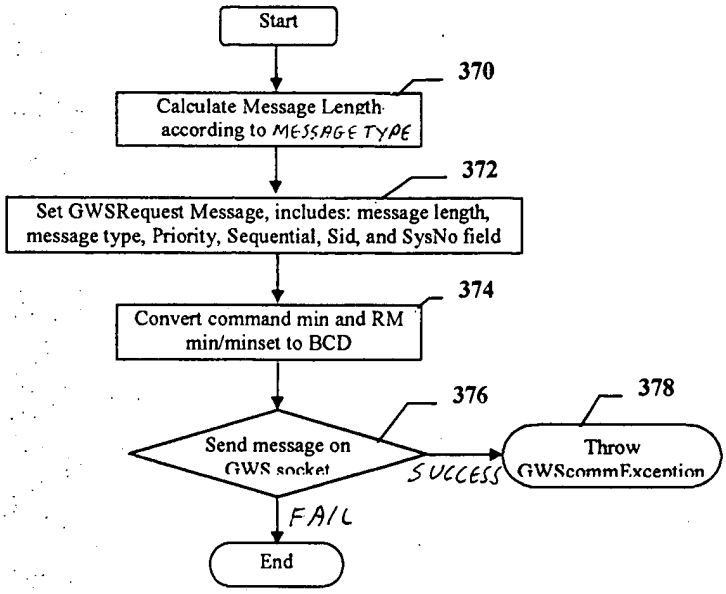

Start
370
Calculate Message Length according to MESSAGE TYPE
372
Set GWSRequest Message, includes: message length, message type, Priority, Sequential, Sid, and SysNo field
374
Convert command min and RM min/minset to BCD
376
378
Send message on GWS socket
SUCCESS
Throw GWScommExcention
FAIL
End

FIG. 9d

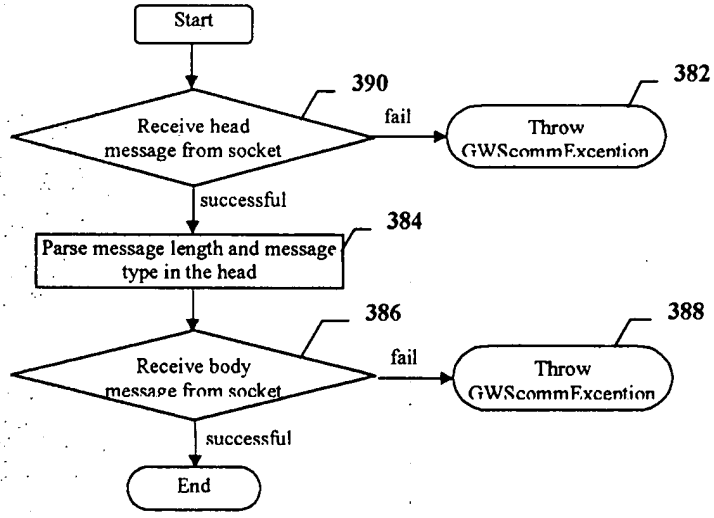

Start
390
382
Receive head message from socket
fail
Throw GWScommExcention
successful
384
Parse message length and message type in the head
386
388
Receive body message from socket
fail
Throw GWScommExcention
successful
End

FIG. 9e

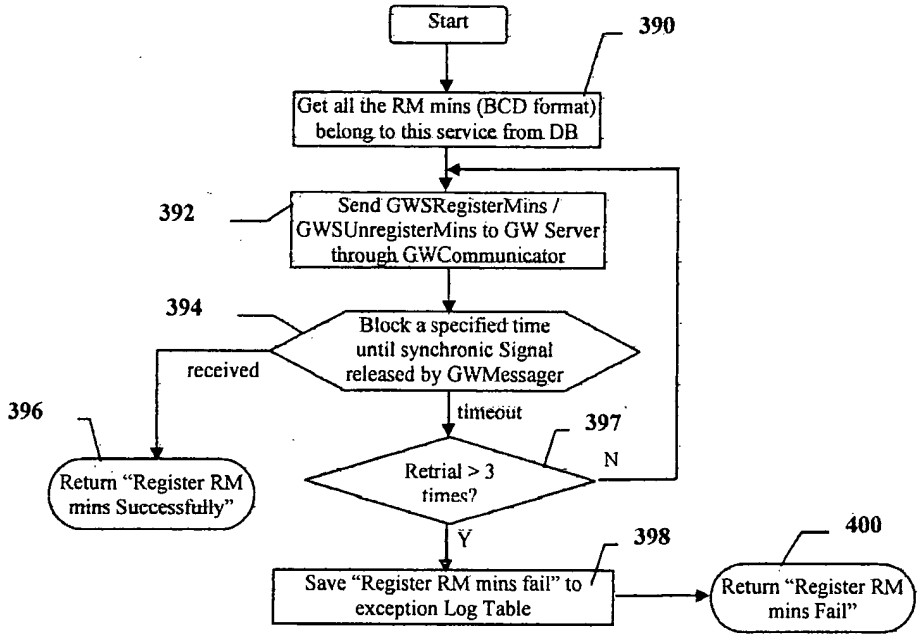

Start
390
Get all the RM mins (BCD format) belong to this service from DB
392
Send GWSRegisterMins / GWSUnregisterMins to GW Server through GWCommunicator
394
Block a specified time until synchronic Signal released by GWMessager
received
timeout
396
397
Retrial > 3 times?
N
Y
Return "Register RM mins Successfully"
398
400
Save "Register RM mins fail" to exception Log Table
Return "Register RM mins Fail"

FIG. 9f

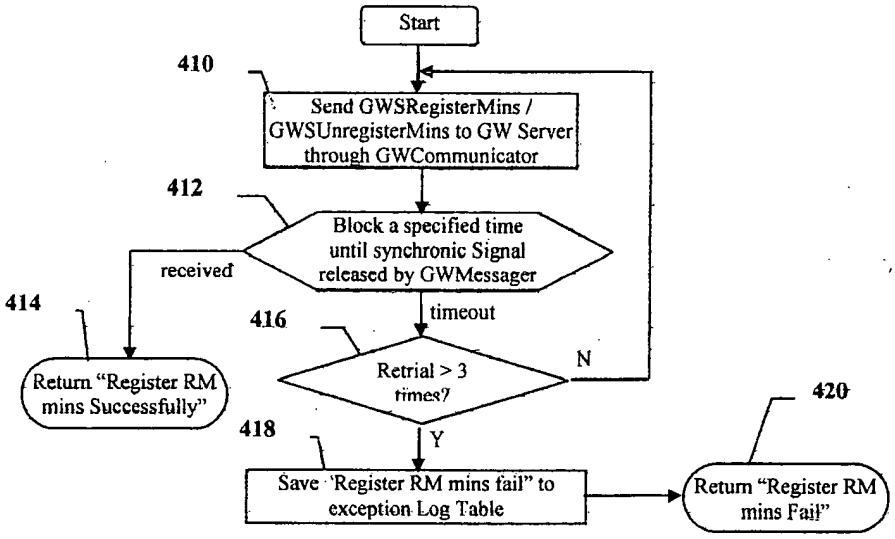

Start
410
Send GWSRegisterMins / GWSUnregisterMins to GW Server through GWCommunicator
412
Block a specified time until synchronic Signal released by GWMessager
received
414
timeout
416
Retrial > 3 times?
N
Return "Register RM mins Successfully"
420
418
Y
Save "Register RM mins fail" to exception Log Table
Return "Register RM mins Fail"

FIG .9g